



South Florida Water Management District

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Memorandum

To: SFWMD/Seminole Agreement Working Group

Through: Leslie Wedderburn, Director, Water Resources Evaluation Dept
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Date: July 31, 1997

Subject: Final Semiannual Progress Report – June 1997

The enclosed first semiannual progress report has been prepared in accordance with the SFWMD/Seminole Tribe Agreement, Paragraph A.3. The report presents the data collected and the results of the total phosphorus load calculations for the period June 1, 1996 through February 28, 1997.

This final report is being distributed at the July 31, 1997 Working Group Meeting and mailed to those Working Group members and interested parties not attending the meeting.

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FINAL

First Semiannual Progress Report

**Total Phosphorus Load Calculations for Sites
Stipulated in the SFWMD/Seminole Tribe Agreement**

By

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and
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July 31, 1997

**Resource Assessment Division
Water Resources Evaluation Department
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West Palm Beach, Florida**

Submitted to

SFWMD/ Seminole Tribe Agreement Working Group

Introduction

The Agreement between the South Florida Water Management District (the District) and the Seminole Tribe of Florida (the Tribe), executed on January 17, 1996, requires periodic monitoring of the quality of surface water entering, originating on and leaving the Big Cypress Seminole Indian Reservation (the Reservation). The ultimate objective of this effort is to ensure that the quality of surface water entering, originating on and leaving the reservation is in or is brought into compliance with applicable water quality standards imposed by law, and to ensure that the overall surface water quality within the Reservation is not adversely impacted.

Pursuant to the Agreement, the District, with the cooperation of the Tribe, initiated a water quality monitoring program in June of 1996 to determine: a) the quality of water delivered to the Reservation through the L-28 Borrow Canal before diversion of all or a portion of the C-139 Basin and C-139 Annex, and b) the quality of water delivered to the Reservation through the North and West Feeder Canals.

To ensure that the quality of water originating on and leaving the Big Cypress Seminole Indian Reservation is in compliance with applicable water quality standards imposed by law, the Tribe, with the assistance from the District, is to monitor a) the quality of water leaving the Big Cypress Reservation through the L-28 Borrow Canal before diversion of the C-139 Basin and the C-139 Annex and b) the quality of water leaving the Reservation through the L-28 Interceptor Canal.

To help the SFWMD/Seminole Agreement Working Group track the results and progress of this monitoring effort, the District is to prepare a report on a semiannual basis which will summarize and analyze the water quality and flow data collected since the implementation of the program.

This first semiannual progress report for the period June 1, 1996 through February 28, 1997 focuses on total phosphorus loads calculated at six of the nine monitoring sites. As of February 28, 1997, total phosphorus data were not yet available for sites at L28IN, L28IS and L28U because of delays in obtaining water quality automatic samplers (auto-samplers) that are equivalent to those being used by the SFWMD. Once on line, the data collected at these sites will be reported in the December 1997 report. Data for the other water quality constituents collected at all sites as stipulated in the Seminole Tribe and District Standard Operating Procedures will also be reported in the December 1997 report.

Methods

Figure 1 is a location map showing the water quality sampling and flow measurement sites that were established for the Agreement. The NFEED, WFEED, USSO, L3BRS, S190 and S140 sites are maintained and sampled by the District. The NFEED, WFEED, USSO and L3BRS sites are equipped with ultrasonic velocity meters (UVMs) to measure

flow and auto-samplers to collect flow-proportional water quality samples. Flow through the S190 spillway and the S140 pump station and box culvert spillway is calculated using structure-specific equations. At both S190 and S140 water quality data are collected by grab sampling procedures. The sites at L28IN and L28U are also equipped with UVMs installed and maintained by the USGS and auto-samplers supplied and operated by the Tribe. The Miccosukee Tribe has a monitoring site located at L28IS which is also equipped with an UVM supplied by the USGS and a Tribe-owned auto-sampler.

Figure 2 is a flow chart depicting the various processes the water quality and hydrologic data acquired from each site are subjected to, from collection to report preparation. All data generated from this monitoring network will eventually reside in the District's database. Figure 3 illustrates how the hydrologic and water quality data are organized within the database and identifies the station names for the stored data.

The computer program used to calculate the total phosphorus loads is based on the Everglades Agricultural Area load model but has been modified to fit the needs of the Agreement. The June 4, 1997 draft of the proposed protocol for calculating the total phosphorus load at each of these monitoring sites, the associated FORTRAN computer program and the total phosphorus concentration data from auto-samplers and grab samples are included as Appendices I, II and III, respectively.

Data Results

The results of the water flow analyses and the computed total phosphorus loads for the sites at NFEED, WFEED, USSO, L3BRS, S190 and S140 are presented in Tables 1, 2 and 3. From the data listed in these tables, a graph was created for each station showing the relationship between flow, total phosphorus values from grab and/or auto-samplers, and the resultant calculated load.

L3BRS

The results for L3BRS are presented in Figure 4. The total load for the entire reporting period was 39,733 kg. A peak load of 17,046 kg occurred in June 1996 while minimum loads were generated during the dry period beginning in December. Because of the low flow conditions occurring in the L-3 Canal during the dry period, small reverse flows possibly caused by wind resulted in minor, short-term negative loads which can be observed in the data.

USSO

Elevated total phosphorus concentrations were observed in much of the data set generated by the auto-sampler at the USSO site. A site investigation was conducted to determine the reason for the anomalous values, and it was found that the sample intake line was lying close to the bottom of the canal. As a result of this discovery, the auto-sampler data for this site has been flagged in the database as questionable and was not used to compute the total phosphorus load for this reporting period. A total phosphorus load of 3712 kg was calculated using the grab sample data collected during the reporting period (Figure 5).

used to calculate flow past the sampling site (Figure 6). The weir equation, however, was judged by the engineers evaluating the flow data to overestimate the high flows that occurred in October and early November 1996. At present, a calibrated flow for this high flow period is not yet available. Consequently, the loads calculated for October and November 1996 may be overestimated. An alternative model UVM has since been installed at the West Feeder site to help resolve this flow issue and is expected to provide improved flow measurements by the end of the summer of 1997.

NFEED

Water flow in the North Feeder Canal is complex and can flow in both directions. When the gate at S190 is closed, the wind and any water entering the North Feeder Canal from the West Feeder Canal just north of S190 can create a circulation pattern that causes both positive and negative velocities to be measured by the UVM. These positive and negative velocities are translated into positive and negative flows at times when there is no net discharge past the UVM site. For this reporting period, the flows were estimated to be zero from 11/20/96 to 04/22/97 because the S190 gate was always closed during this period. At times of discharge through S190 both positive and negative flows also occur at the NFEED UVM site. For this reason both positive and negative flows are reported and the associated positive and negative total phosphorus loads are calculated and included in the data set. It is important to note that the autosampler does not take a water sample when the UVM is recording negative flows. This ensures that a volume of water is not sampled more than once as it flows back and forth past the sampling site. A total phosphorus concentration of 1,296 ppb was collected in the auto-sampler during the week ending July 25, 1996 when the sampler overflowed (Figure 7). Heavy suspended solids and bits of vegetation were found in the sample bottles. This composite sample has been flagged in the database as being contaminated. Without this value, the total phosphorus load for July 1996 was 1317 kg. The calculated load for this entire reporting period was 5743 kg.

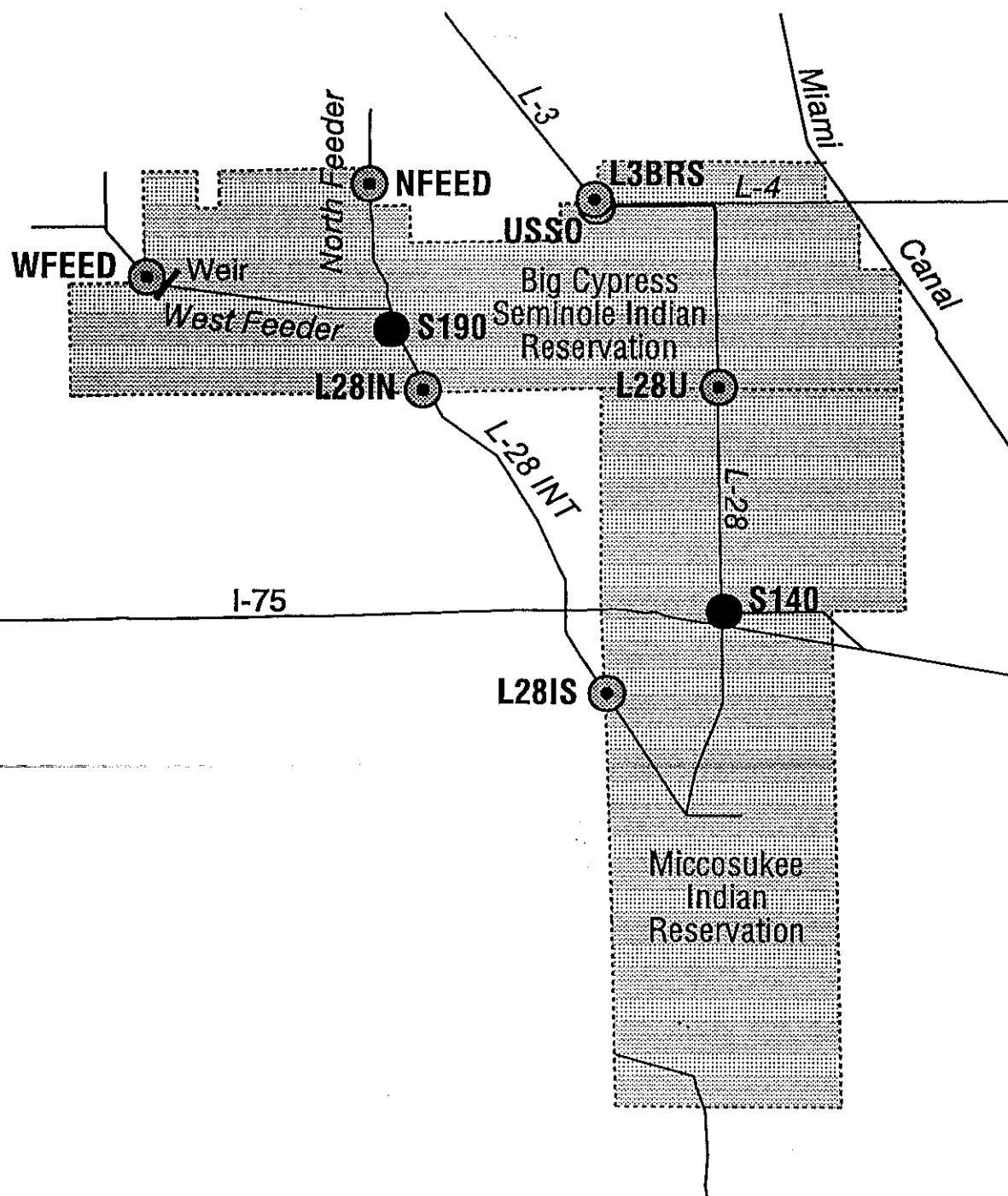
S190

Structure S190 is a gated spillway that is operated to control stages in the North and West Feeder Canals. Flow through S190 is computed using an uncontrolled, submerged flow equation. The result of the load calculation for S190 is presented in Figure 8. After the high flow period in October and November 1996, the S190 gate was closed for the remainder of the reporting period. The calculated total phosphorus load for this entire reporting period was 9887 kg. The sums of flows and, thus, resultant loads from the North Feeder and West Feeder Canals were greater than those values measured at S190. It is expected that the computed loads will be more comparable or equivalent when the flow measurement issue at the West Feeder site is resolved.

S140

Structure S140 is comprised of a pump station and a box culvert spillway that are operated to discharge excess drainage water from the L-28 Canal into WCA-3A. For the purposes of load calculations the sum of the pumped and spillway flow is used. The result of the total phosphorus load calculation for S140 is presented in Figure 9. The total load for this entire reporting period was 4869 kg.

Figure 1: SFWMD/Seminole Agreement Water Quality and Flow Sampling Sites

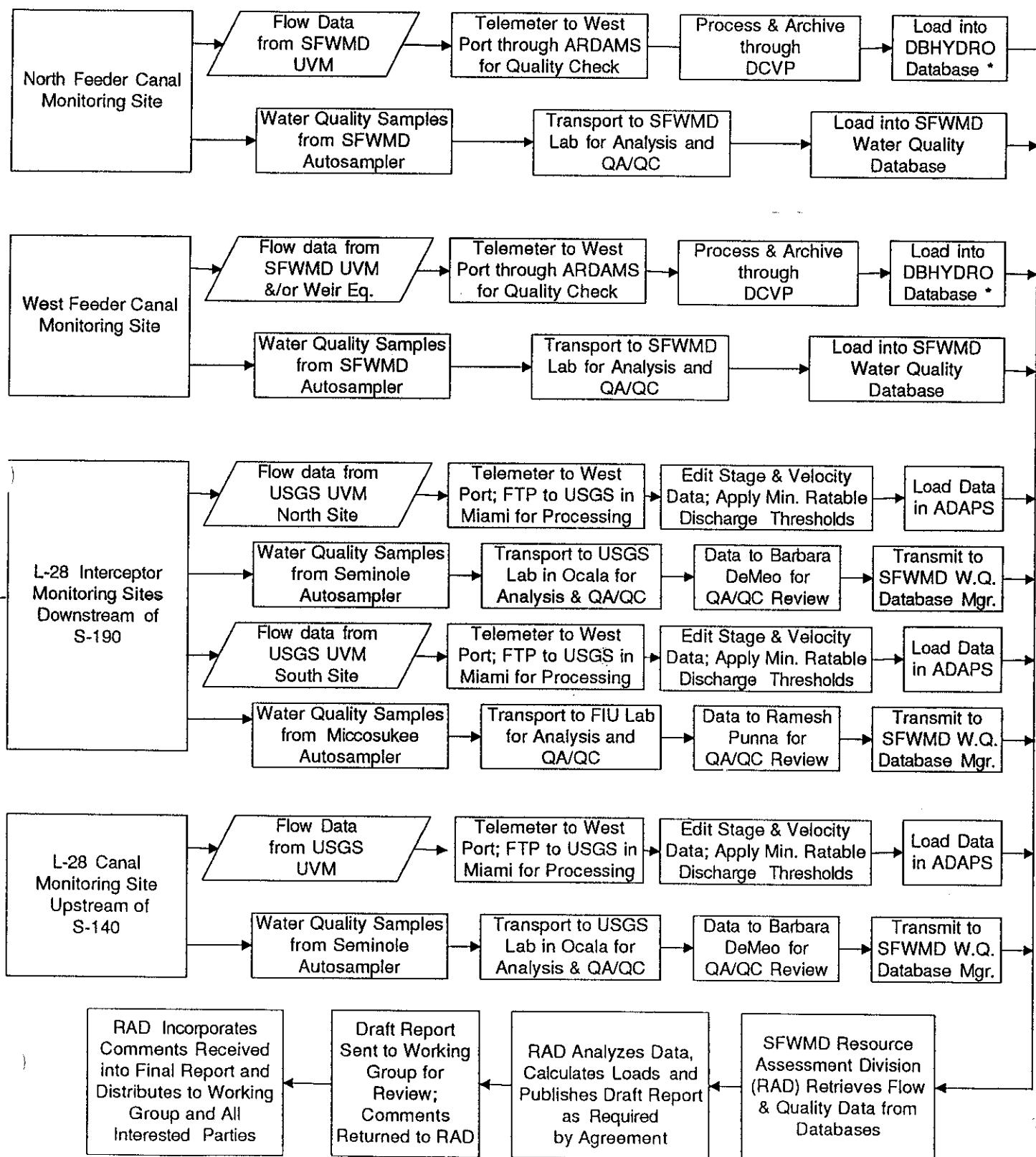


- Major Canal
- Grab samples and flow through structures
- (○) Autosamplers and flows from UVMS



Figure 2. Flow Chart for Water Flow and Water Quality Data Collected for the SFWMD/Seminole Cooperative Agreement

Final: 3/28/97



Definition of Acronyms Used in the Data Collection Flow Chart (Figure 2)

ADAPS: Automated Data and Processing System (USGS)

ARDAMS: Automatic Remote Data Acquisition and Monitoring System (SFWMD)

DBHYDRO: Hydrological Data Base (SFWMD)

DCVP: Data Collection/Validation Preprocessing System (SFWMD)

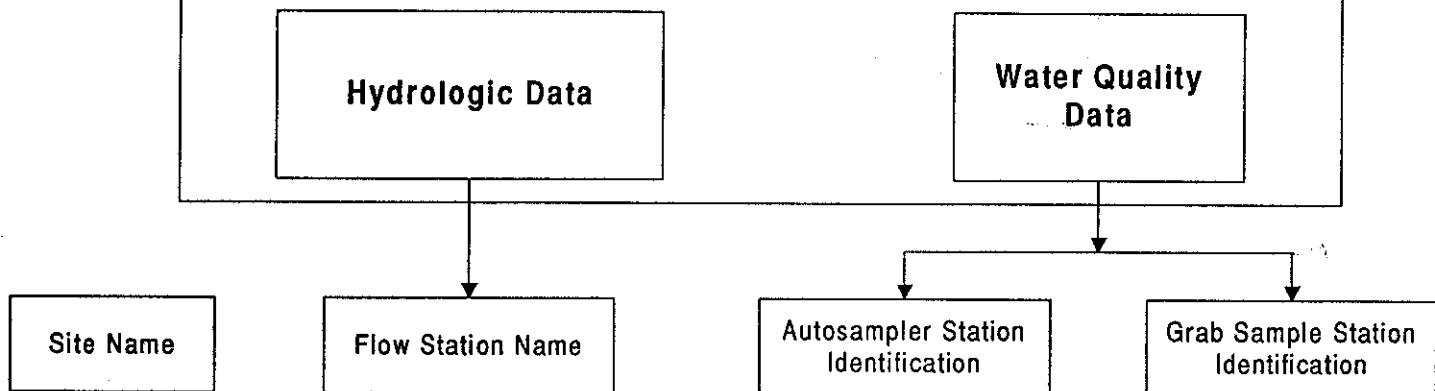
FTP: File Transfer Protocol (Universal)

UVM: Ultrasonic Velocity Meter (Universal)

Figure 3. SFWMD/Seminole Agreement Sampling Station Names

4th Draft 6-1-97

DBHYDRO Database



NFEED	NFEED_O	NFEED	None
WFEED	WFEED_O	WFEED	None
L3BRS	L3BRS_O	USL3BRS	L3BRS
USSO	USSO_O	USSO	USSO
S190	S190_S	None	S190
S140	S140_T	None	S140
L28U	L28U_O	L28U	BCS7
L28IN	L28IN_O	L28IN	BCS5
L28IS	L28IS_O	L28IS	L28I @ I75

Table 1. Seminole/SFWMD Agreement total phosphorus and flow data summary and load calculation output summary for the period: June 1, 1996 - February 28, 1997.

For nfeed:

term	clab	glab	qlab	dbkey,qsign,ittype,iymdtp
nfeed	NFEED	none	NFEED_0	16754 1 1 19960619

Flow data from 19960601 to 19970228

composite sample missing more than 2 weeks after 19960531

Composite sample n = 33
first datum : 19960626
last datum : 19970220
average value = 119.8
range = less than 4 to 351

Number of no flow days = 100

Number of positive flow days = 150 Total(cfs-d) = 10198.3

Number of negative flow days = 23 Total(cfs-d) = -378.3

0 missing flow data

For wfeed:

term	clab	glab	qlab	dbkey,qsign,ittype,iymdtp
wfeed	WFEED	none	WFEED_0	16752 1 1 19960606

Flow data from 19960601 to 19970228

composite sample missing more than 2 weeks after 19960718

composite sample missing more than 2 weeks after 19960904

composite sample missing more than 2 weeks after 19961211

composite sample missing more than 2 weeks after 19970123

Composite sample n = 19
first datum : 19960613
last datum : 19970220
average value = 49.0
range = 9 to 119

Number of no flow days = 40

Number of positive flow days = 233 Total(cfs-d) = 30366.3

Number of negative flow days = 0 Total(cfs-d) = 0.0

0 missing flow data

For l3brs:

term clab glab qlab dbkey,qsign,itype,iymdtp
l3brs USL3BRS L3BRS L3BRS_O 16245 1 2 19841030

Flow data from 19960601 to 19970228

composite sample missing more than 2 weeks after 19961211
composite sample missing more than 2 weeks after 19970130

Grab sample n = 16
first datum : 19960613
last datum : 19970220
average value = 140.1
range = 41 to 425
grab sample used (n w/ +flow) = 16
load ratio to comp (autosampler) = 0.995821

Composite sample n = 31
first datum : 19960606
last datum : 19970306
average value = 164.1
range = 19 to 487

Number of no flow days = 0
Number of positive flow days = 269 Total (cfs-d) = 64688.6
Number of negative flow days = 4 Total (cfs-d) = -37.4
0 missing flow data

For usso:

term clab glab qlab dbkey,qsign,itype,iymdtp
usso USSO USSO USSO_O 16749 1 0 19960222

Flow data from 19960601 to 19970228

Grab sample n = 16
first datum : 19960613
last datum : 19970220
average value = 83.4
range = 30 to 170
grab sample used (n w/ +flow) = 16

Composite sample n = 40
first datum : 19960606
last datum : 19970312

Number of no flow days = 0
Number of positive flow days = 273 total (cfs-d) = 17641.5
Number of negative flow days = 0
0 missing flow data

For s190:

term clab glab qlab dbkey,qsign,ittype,iymdtp
s190 none S190 S190_S 15987 1 0 19870422 ..

Flow data from 19960601 to 19970228

Grab sample n = 16
first datum : 19960613
last datum : 19961114
average value = 87.4
range = 20 to 244
grab sample used (n w/ +flow) = 10

Number of no flow days = 116
Number of positive flow days = 157 total (cfs-d) = 29947.6
Number of negative flow days = 0
0 missing flow data

For s140:

term clab glab qlab dbkey,qsign,ittype,iymdtp
s140 none S140 S140_T 06754 1 0 19771227

Flow data from 19960601 to 19970228

grab sample n = 16
first datum : 19960613
last datum : 19961127
average value = 45.0
range = 22 to 113
grab sample used (n w/ +flow) = 13

Number of no flow days = 105
Number of positive flow days = 167 total (cfs-d) = 46732.0
Number of negative flow days = 1 total (cfs-d) = -11.8
0 missing flow data

For l28u:

term clab glab qlab dbkey,qsign,ittype,iymdtp
l28u L28U BCS7 L28U_O FF811 1 2 19991231

0 flow data ..

For l28in:

term clab glab qlab dbkey,qsign,ittype,iymdtp
l28in L28IN BSC5 L28IN_O FF810 1 2 19991231

0 flow data

For L28is:

term clab glab qlab dbkey,qsign,itype,iymdtp
L28is L28IS L28I@175L28IS_O FF813 1 2 19991231

0 flow data

**Seminole/SFWMD Phosphorus Load Calculation Output:
Totals & Averages for the Calculation Time Period:
June 1, 1996 to February 28, 1997**

Term	Flow(kacf)	Load(kg)	FWM Conc(ppb)
'NFEED	20.228	-0.750	5742.536 -212.689 230.0
'WFEED	60.231	0.000	4721.647 0.000 63.5
'L3BRS	128.308	-0.074	39733.410 -2.145 250.9
'USSO	34.991	0.000	3712.227 0.000 85.9
'S190	59.400	0.000	9887.348 0.000 134.8
'S140	92.692	-0.023	4868.911 -0.636 42.6
'L28U	,		
'L28IN	,		
'L28IS	,		

Table 2. Seminole/SFWMD Agreement total phosphorus load calculations monthly flows and loads for the period: June 1, 1996 - February 28, 1997.

Positive flows in million cubic meters

Month	NFEED	WFED	L3BRS	USSO	S190	S140
199606	7.833	11.195	46.626	10.468	22.292	33.055
199607	5.475	6.694	29.464	8.209	12.315	26.878
199608	1.821	3.560	24.698	5.539	6.727	11.926
199609	2.393	3.518	11.754	5.110	5.918	11.896
199610	6.592	37.272	33.954	5.911	22.250	20.720
199611	0.856	9.517	7.699	2.874	3.816	5.780
199612	0.000	1.808	2.301	2.001	0.005	2.537
199701	0.000	0.568	0.831	1.556	0.000	1.101
199702	0.000	0.219	1.061	1.526	0.003	0.529

Negative flows in million cubic meters

Month	NFEED	WFED	L3BRS	USSO	S190	S140
199606	-0.402	0.000	0.000	0.000	0.000	0.000
199607	-0.119	0.000	0.000	0.000	0.000	0.000
199608	-0.246	0.000	0.000	0.000	0.000	0.000
199609	-0.087	0.000	0.000	0.000	0.000	0.000
199610	-0.019	0.000	0.000	0.000	0.000	0.000
199611	-0.054	0.000	0.000	0.000	0.000	0.000
199612	0.000	0.000	-0.058	0.000	0.000	-0.029
199701	0.000	0.000	-0.034	0.000	0.000	0.000
199702	0.000	0.000	0.000	0.000	0.000	0.000

loads in kg

Month	NFEED	WFED	L3BRS	USSO	S190	S140
199606	2728.164	832.265	17046.420	703.673	3900.962	1246.996
199607	1316.749	332.584	6749.057	914.514	1782.947	1138.580
199608	222.300	144.799	5189.561	714.145	618.709	992.441
199609	-243.010	213.533	1341.363	558.521	496.143	601.919
199610	1123.160	2864.106	8334.641	406.935	2792.687	655.139
199611	109.153	305.649	926.226	116.280	295.419	142.177
199612	0.000	17.728	82.566	102.900	0.261	55.811
199701	0.000	7.923	19.272	92.897	0.027	24.218
199702	0.000	3.061	44.302	102.362	0.192	11.630

Negative loads in kg

Month	NFEED	WFED	L3BRS	USSO	S190	S140
199606	-141.029	0.000	0.000	0.000	0.000	0.000
199607	-19.647	0.000	0.000	0.000	0.000	0.000
199608	-34.614	0.000	0.000	0.000	0.000	0.000
199609	-10.009	0.000	0.000	0.000	0.000	0.000
199610	-1.373	0.000	0.000	0.000	0.000	0.000
199611	-6.017	0.000	0.000	0.000	0.000	0.000
199612	0.000	0.000	-1.365	0.000	0.000	-0.636
199701	0.000	0.000	-0.780	0.000	0.000	0.000
199702	0.000	0.000	0.000	0.000	0.000	0.000

Table 3. Seminole/SFWMD Agreement total phosphorus load calculation monthly summary by station name for the period: June 1, 1996 - February 28, 1997.

Flows in million cubic meter (kacre-feet)

station	month	day	flow	load(kg)	fwmc(ppb)	flow_neg	load_neg
NFEED	199606	30	7.8(6.3)	2728.2	348.3	-0.4(-0.3)	-141.0
NFEED	199607	31	5.5(4.4)	1316.7	240.5	-0.1(-0.1)	-19.6
NFEED	199608	31	1.8(1.5)	222.3	122.1	-0.2(-0.2)	-34.6
NFEED	199609	30	2.4(1.9)	243.0	101.5	-0.1(-0.1)	-10.0
NFEED	199610	31	6.6(5.3)	1123.2	170.4	-0.02(-.02)	-1.4
NFEED	199611	30	0.9(0.7)	109.2	127.4	-0.05(-.04)	-6.0
NFEED	199612	31	0.0(0.0)	0.0	N/A	0.0(0.0)	0.0
NFEED	199701	31	0.0(0.0)	0.0	N/A	0.0(0.0)	0.0
NFEED	199702	28	0.0(0.0)	0.0	N/A	0.0(0.0)	0.0
WFEED	199606	30	11.2(9.1)	832.3	74.3	0.0(0.0)	0.0
WFEED	199607	31	6.7(5.4)	332.6	49.7	0.0(0.0)	0.0
WFEED	199608	31	3.6(2.9)	144.8	40.7	0.0(0.0)	0.0
WFEED	199609	30	3.5(2.9)	213.5	60.7	0.0(0.0)	0.0
WFEED	199610	31	37.3(30.2)	2864.1	76.8	0.0(0.0)	0.0
WFEED	199611	30	9.5(7.7)	305.6	32.1	0.0(0.0)	0.0
WFEED	199612	31	1.8(1.5)	17.7	9.8	0.0(0.0)	0.0
WFEED	199701	31	0.6(0.5)	7.9	14.0	0.0(0.0)	0.0
WFEED	199702	28	0.2(0.2)	3.1	14.0	0.0(0.0)	0.0
L3BRS	199606	30	46.6(37.8)	17046.4	365.6	0.0(0.0)	0.0
L3BRS	199607	31	29.5(23.9)	6749.1	229.1	0.0(0.0)	0.0
L3BRS	199608	31	24.7(20.0)	5189.6	210.1	0.0(0.0)	0.0
L3BRS	199609	30	11.8(9.5)	1341.4	114.1	0.0(0.0)	0.0
L3BRS	199610	31	34.0(27.5)	8334.6	245.5	0.0(0.0)	0.0
L3BRS	199611	30	7.7(6.2)	926.2	120.3	0.0(0.0)	0.0
L3BRS	199612	31	2.3(1.9)	82.6	35.9	-0.06(-.05)	-1.4
L3BRS	199701	31	0.8(0.7)	19.3	23.2	-0.03(-.03)	-0.8
L3BRS	199702	28	1.1(0.9)	44.3	41.7	0.0(0.0)	0.0
USSO	199606	30	10.5(8.5)	703.7	67.2	0.0(0.0)	0.0
USSO	199607	31	8.2(6.6)	914.5	111.4	0.0(0.0)	0.0
USSO	199608	31	5.5(4.5)	714.1	128.9	0.0(0.0)	0.0
USSO	199609	30	5.1(4.1)	558.5	109.3	0.0(0.0)	0.0
USSO	199610	31	5.9(4.8)	406.9	68.8	0.0(0.0)	0.0
USSO	199611	30	2.9(2.3)	116.3	40.5	0.0(0.0)	0.0
USSO	199612	31	2.0(1.6)	102.9	51.4	0.0(0.0)	0.0
USSO	199701	31	1.6(1.3)	92.9	59.7	0.0(0.0)	0.0
USSO	199702	28	1.5(1.2)	102.4	67.1	0.0(0.0)	0.0
S190	199606	30	22.3(18.1)	3901.0	175.0	0.0(0.0)	0.0
S190	199607	31	12.3(10.0)	1782.9	144.8	0.0(0.0)	0.0
S190	199608	31	6.7(5.4)	618.7	92.0	0.0(0.0)	0.0
S190	199609	30	5.9(4.8)	496.1	83.8	0.0(0.0)	0.0
S190	199610	31	22.2(18.0)	2792.7	125.5	0.0(0.0)	0.0
S190	199611	30	3.8(3.1)	295.4	77.4	0.0(0.0)	0.0
S190	199612	31	0.005(.004)	0.3	56.0	0.0(0.0)	0.0
S190	199701	31	0.000(.000)	0.0	N/A	0.0(0.0)	0.0
S190	199702	28	0.003(.003)	0.2	56.0	0.0(0.0)	0.0

S140	199606	30	33.1(26.8)	1247.0	37.7	0.0(0.0)	0.0
S140	199607	31	26.9(21.8)	1138.6	42.4	0.0(0.0)	0.0
S140	199608	31	11.9(9.7)	992.4	83.2	0.0(0.0)	0.0
S140	199609	30	11.9(9.6)	601.9	50.6	0.0(0.0)	0.0
S140	199610	31	20.7(16.8)	655.1	31.6	0.0(0.0)	0.0
S140	199611	30	5.8(4.7)	142.2	24.6	0.0(0.0)	0.0
S140	199612	31	2.5(2.1)	55.8	22.0	-0.03(-.02)	-0.6
S140	199701	31	1.1(0.9)	24.2	22.0	0.0(0.0)	0.0
S140	199702	28	0.5(0.4)	11.6	22.0	0.0(0.0)	0.0

Figure 4: L3BRS TP Load, Flow and TP Concentration

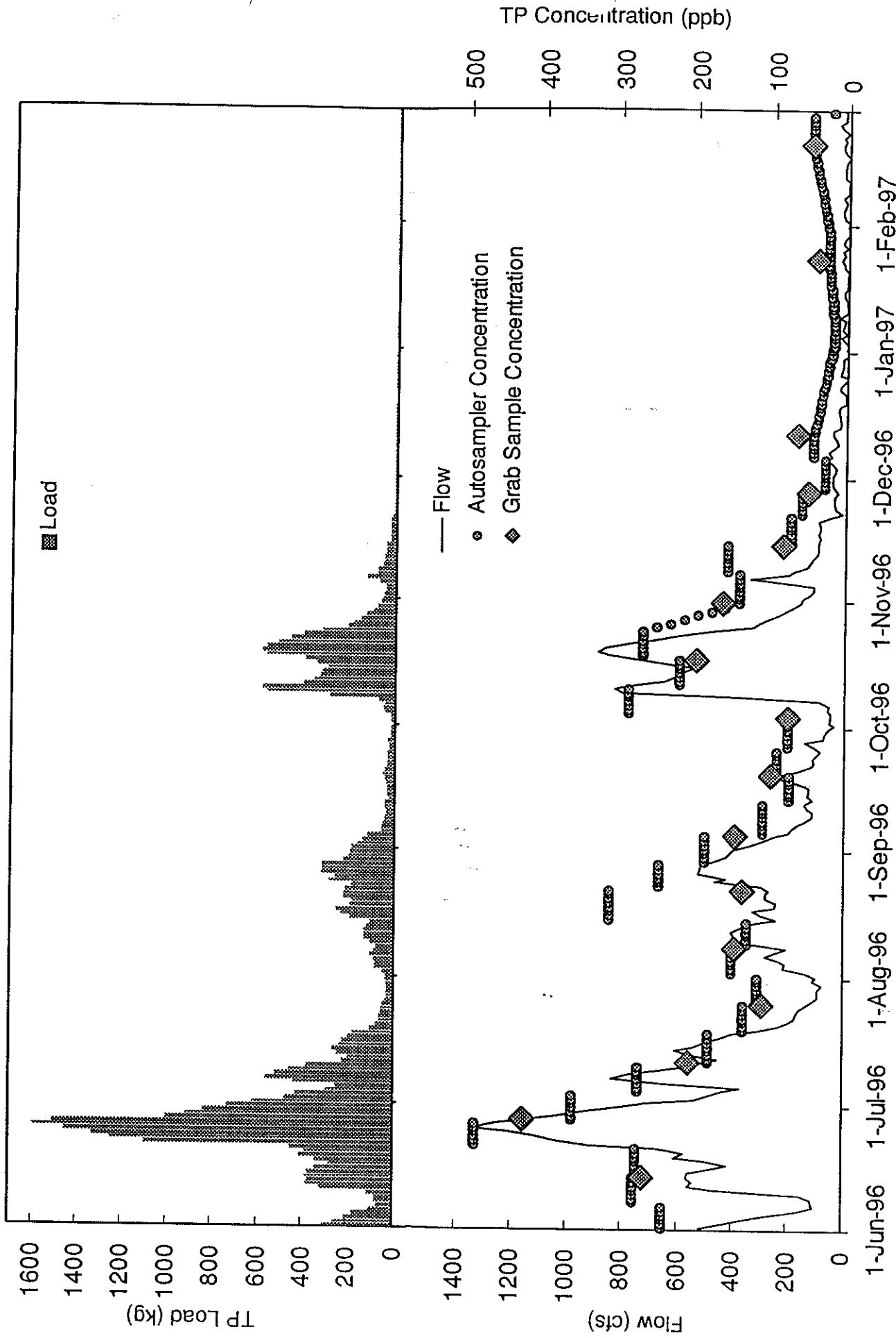


Figure 5: USSO TP Load, Flow and TP Concentration

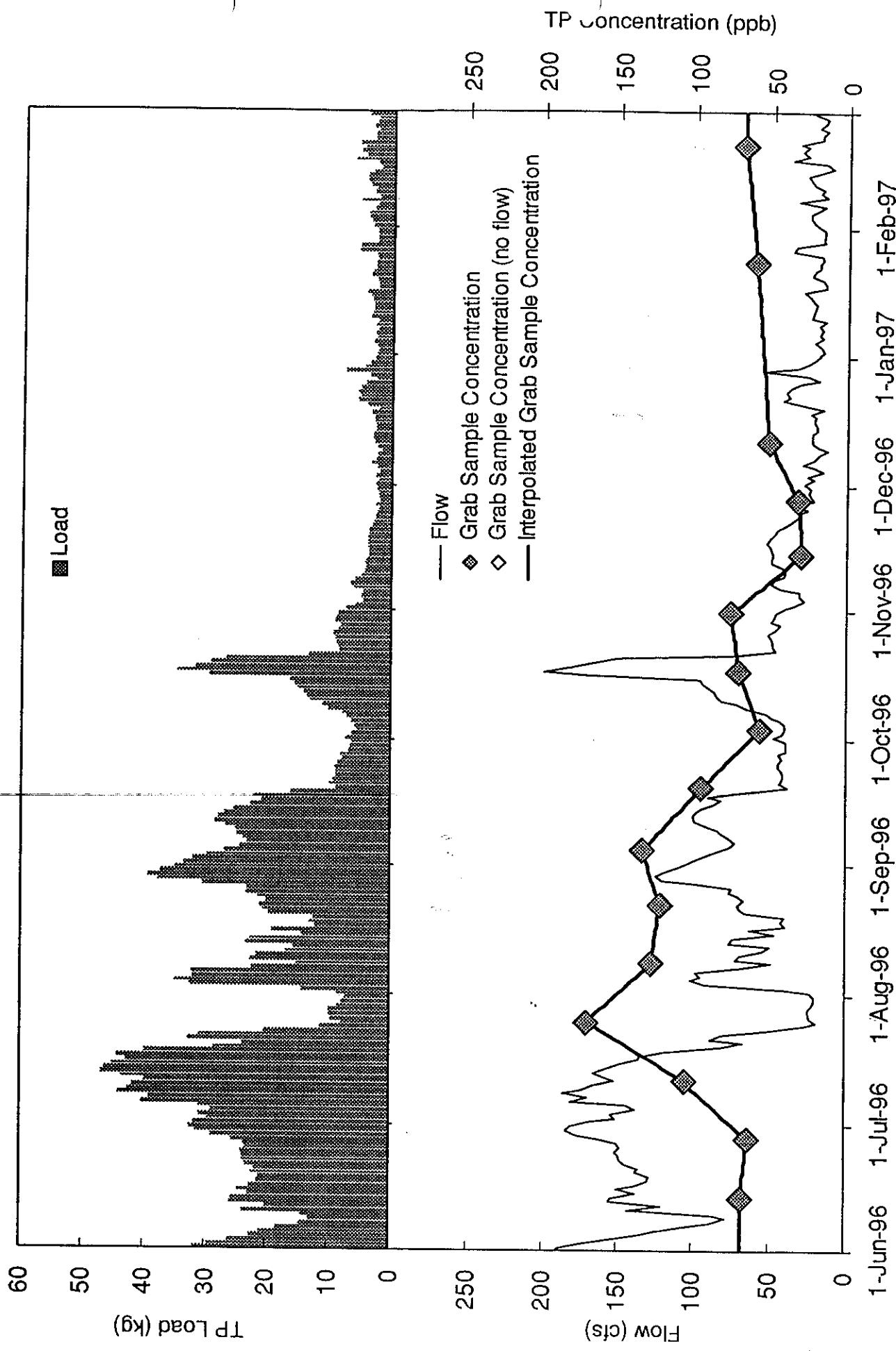


Figure 6: WFEED TP Load, Flow and TP Concentration

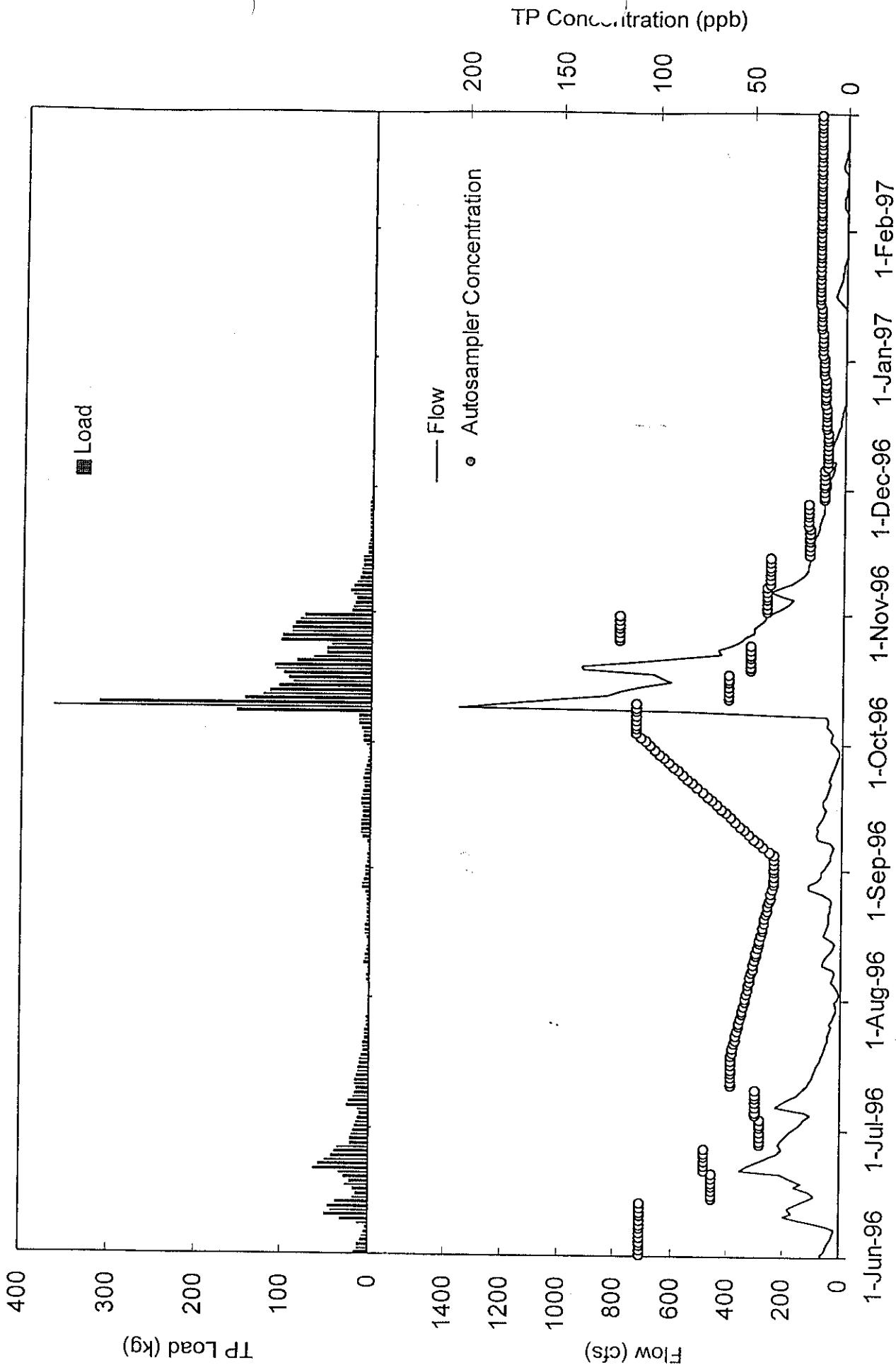


Figure 7: NFEED TP Load, Flow and TP Concentration

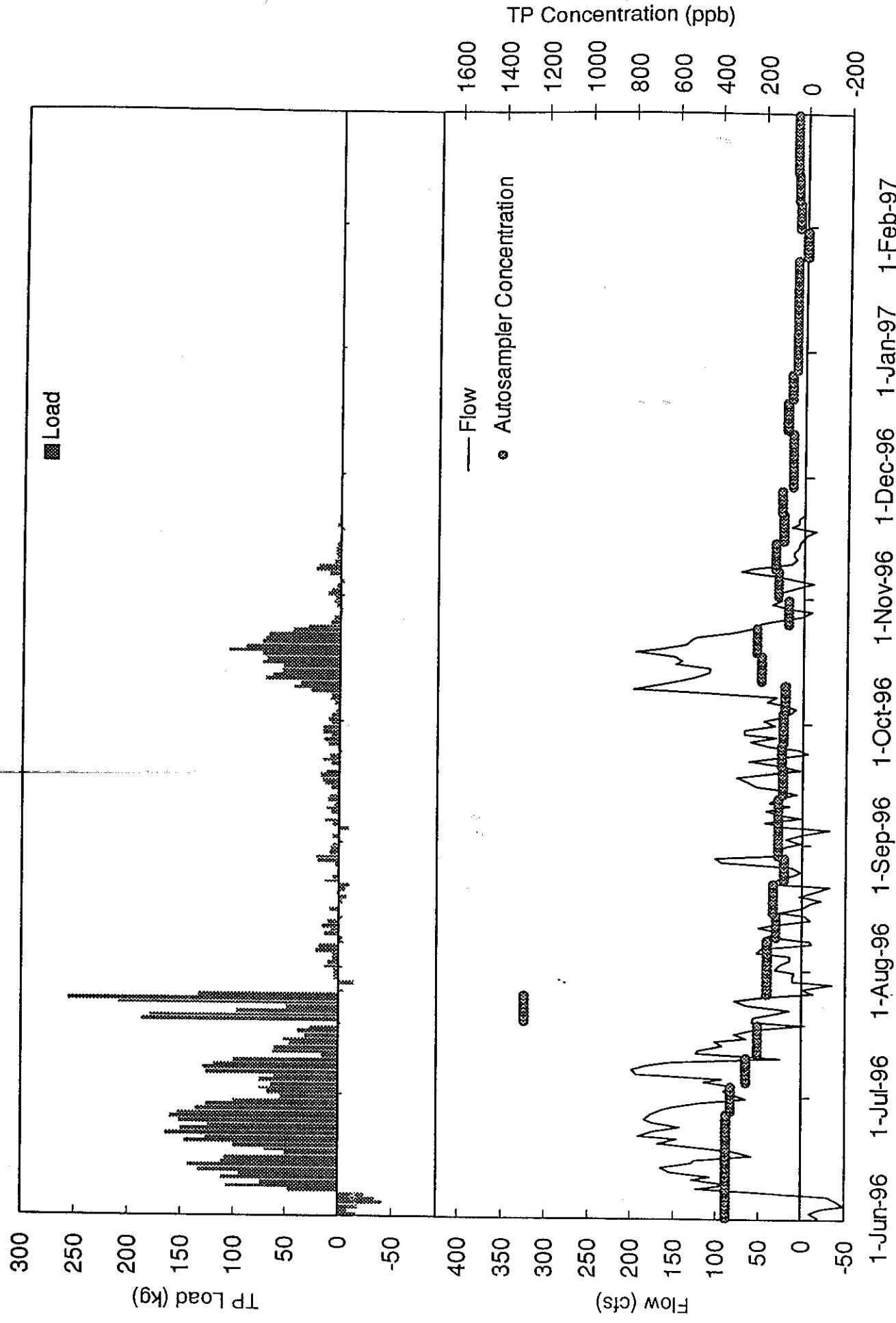


Figure 8: S190 TP Load, Flow and TP Concentration

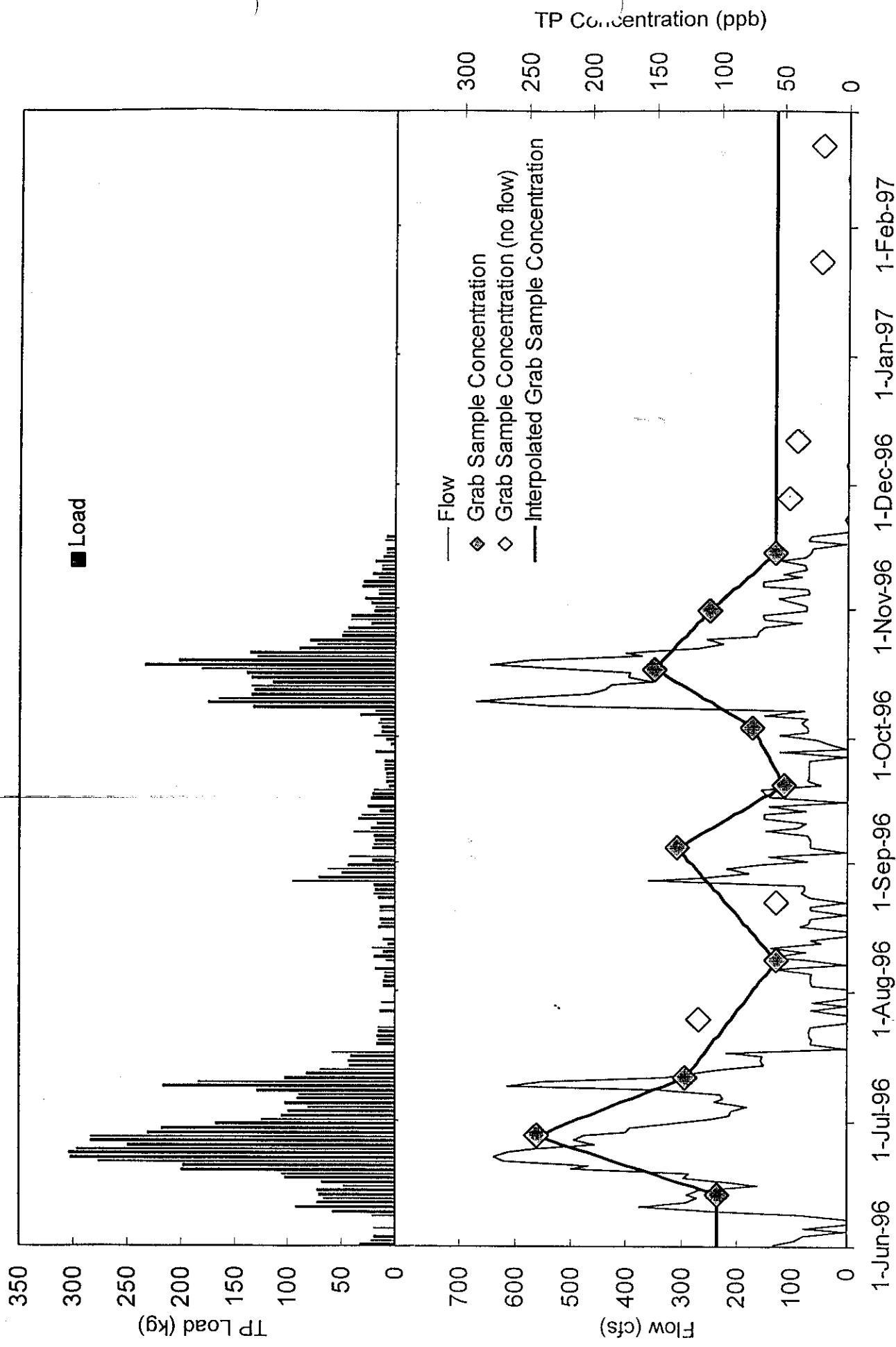
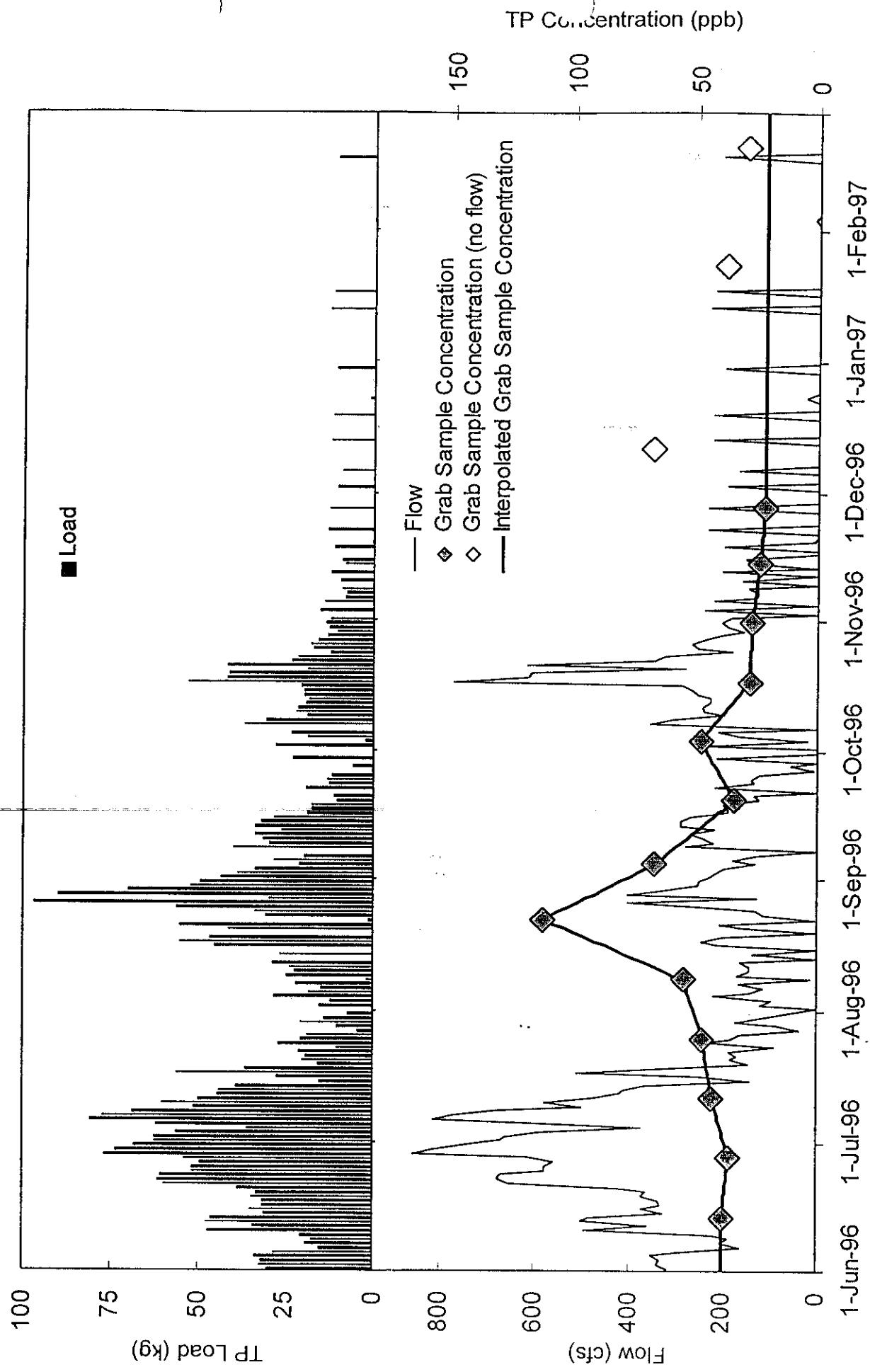


Figure 9: S140 TP Load, Flow and TP Concentration



Appendix I

Proposed TP Load Calculation Protocol

The Second DRAFT on June 4, 1997

The purpose of this "the total phosphorus (TP) load calculation program" proposed for the SFWMD/Seminole Agreement proposed here is to calculate the current TP loads at selected locations and to present the results to the SFWMD/Seminole Working Group for water resource management decision making.

The following procedure is proposed for the SFWMD/Seminole Agreement TP load calculations.

1. Data retrieval and distribution.

Data are retrieved from the District's databases by executing SQL commands (scripts) of a database program ORACLE at a District Sun workstation or by the use of the District's REMO, a remote access link to the SFWMD's databases.

- a) Daily mean flow (cfs) data are retrieved from the "dm_daily_data" table.
- b) Total phosphorus concentration (ppm) date are retrieved from the "sample" table.

Requirements:

- a) A missing autosampler total phosphorus sample should have a blank entry (without a flag) in the water quality database.
- b) There should be "Preferred" dbkeys for the 9 structures of this project in the flow database. The dbkey should contain daily mean flow (cfs) data for the entire structure without any missing values for the period, i.e., every (daily) entry for the reporting quarter should have a value (measured, estimated or zero).
- c) Because the sampling period of an autosampler is one week, the sampler that started collecting water on the last day of the month will not be reported, at the least, until the 6th day of the next month. To include these end-of-the-quarter data in the load calculation, TP data in the database should extend at least one week beyond the end of the reporting quarter.

2. Loading the data into a working computer.

The data files are in UNIX ASCII format. They may be needed to go through a program to make it suitable for a personal computer (PC) if your work station is an IBM compatible PC. This step and subsequent steps could be automated by using a batch program for a PC. A UNIX work station (such as SUN Sparcstation) could use a shell script for the

same purpose.

Requirements:

- a) A user should make a Remote Electronic Access Agreement Contract with the District to log-on to REMO or the user should have the access to the Internet to download the data files from the District FTP site.
- b) A FORTRAN compiler. The load calculation program is written in FORTRAN programming language following the f77 standard to make it compilable in any computer platform. The District can distribute the compiled, thus executable program for SUNOS4 or SUN Solaris2 operating system workstations. PC users, however, should have a FORTRAN compiler (such as Microsoft Powerstation or Lahey FORTRAN f77) available.

3. Outliers and obviously bad data will be checked for their validity by manually inspecting the data, consulting the field log, or consulting with QA/QC officers. The manual confirmation of data is recommended for outlier checking because the statistical automatic process will make the calculation very unstable for the project. Any treatment of data at this step (deletion or correction) will be noted in the report.
4. Calculate the daily load and sum for monthly load for each structure.

The use of the interpolation of the two adjacent period autosampler values to fill in the missing data is recommended because: 1) grab sampling is of secondary importance (only biweekly while the autosamples will be collected weekly), 2) the autosamplers are very reliable and missing values are rather rare occurrences, and 3) there will be not enough data initially to establish the relationship between grab and autosampler values.

The algorithm of the calculation program is:

- a) Fill in the daily TP concentrations by interpolating the values of adjacent two grab sample data
- b) Fill in the daily TP concentrations for the seven days including and prior to the autosampler values. If there is a gap longer than seven days, fill in the missing daily TP values for the period by interpolating the two autosampler data adjacent to the missing periods.
- c) Calculate daily load by multiplying daily TP concentration by corresponding daily flow.
- d) Sum up daily flows and loads for each month and for positive and negative values separately.

- e) Continue the process for the next month.
- f) Write the monthly output to a file.
- g) Repeat the steps for the next station.

5. Generation of Report.

The output of the above program run will contain flow (in cubic meters and in acre-feet), load (in kg), and flow-weighted mean concentration data (in ppb) for each month for the 9 structures. Additional output will be generated for negative (back-flow) conditions in the North Feeder Canal.

When data for a full year are available, 12-month moving sums of TP loads will be calculated and reported.

This is a proposal for the TP load calculation protocol. Please direct comments or suggestions to Tim Bechtel (x6392, tim.bechtel@sfwmd.gov) or Cheol Mo (x2106, cheol.mo@sfwmd.gov) at SFWMD.

Appendix II

'Seminole/SFWMD Phosphorus Load Calculations: June 30, 1997 '
'semflow.dat' 'flowtab.out'
'semtcp.dat' 'input concentration file'
7 'nmaxc = max days for composite sample allocation'
19960601 'dbase = first date for load calculation'
'seminv.out' 'output sample inventory file'
'semday.out' , ,
'semmon.out' 'monthly output file (flow, load, fwmtpc by term/mo)'
'semtab.out' 'output cross-tabulation (term x month)'

term	comp	grab	flow	dbkey	qsign	itype	tpdate
'nfeed'	'NFEED	'none	'NFEED_O'	'16754'	1	1	19960619
'wfeed'	'WFEED	'none	'WFEED_O'	'16752'	1	1	19960606
'l3brs'	'USL3BRS	'L3BRS	'L3BRS_O'	'16245'	1	2	19841030
'usso'	'USSO	'USSO	'USSO_O'	'16749'	1	0	19960222
's190'	'none	'S190	'S190_S'	'15987'	1	0	19870422
's140'	'none	'S140	'S140_T'	'06754'	1	0	19771227
'l28u'	'L28U	'BCS7	'L28U_O'	'FF811'	1	2	19991231
'l28in'	'L28IN	'BSC5	'L28IN_O'	'FF810'	1	2	19991231
'l28is'	'L28IS	'L28I@175'	'L28IS_O'	'FF813'	1	2	19991231

```

c ****
c Seminole/SFWMD Agreement Total Phosphorus Load Calculation Program.
c ****
c
c program Semtpld
c
c first version 6/4/1997
c last revision: 6/30/1997
c usage:
c       >semtpld job.sem
c sem.job = input ascii file specifying case conditions
c
c maximum dimensions:
c   number of days = 6000 = 16+ years ~ (1996-2012)
c   number of grab samples = 1000 per station
c   number of composite samples = 1000 per station
c   maximum number of terms = 20
c
c   character*64 title
c   character*12 ofile1,ofile2,ofile3,ofile4,cfile,qfile
c   &           ,qfile_tab
c   character*12 blank '/'
c   character*8 dum8,term,clab,glab,qlab,stations(20)
c   character*12 jobfile
c   character*5 dbkey,dbkeys(20)
c
c logical loadcalc
c
c integer*4 iym(200),dlast,dbase,qsign,flowtype(3)
c
c real monflow,monload,monflown,monloadn
c   & flowmon,loadmon,flowmonn,loadmonn
c
c common /a/ dayflow(6000),dayccomp(6000),daycgrab(6000)
c   & ,cgrabint(6000),dayload(6000)
c common /b/ cgrab(1000),ccomp(1000),x(1000),y(1000)
c common /c/ idgrab(1000),idcomp(1000)
c common /d/ monflow(200,20),monload(200,20)
c   & ,monflown(200,20),monloadn(200,20)
c
c data monflow/4000*-999.0/,monload/4000*-999.0/
c   & ,monflown/4000*-999.0/,monloadn/4000*-999.0/
c
c array definitions:
c   dayflow() = daily flow
c   dayload() = daily load computed
c   egrab() = grab sample concentration
c   idgrab() = grab sample date
c   ccomp() = composite sample concentration
c   idcomp() = composite sample date
c
c flow type:
c   0 no flow
c   1 positive flow
c   2 negative flow
c
c convert cfs*ppb to kg/day
c   sfkg=24.0*3600.0/3.28**3/1.0e6
c convert cfad to kac-ft
c   sfkacf=24.*3600./43560./1000.
c missing value representation
c   xmis=-999.0
c
c get the name of job-control-file
c   call getarg(1,jobfile)
c
c read job control file to get station information and input parameters
c   open(7,file=jobfile,status='old')
c
c read control parameters
c   read(7,*) title,qfile,qfile_tab,cfile,dum8
c   & ,nmaxc,dum8,dbase,dum8
c
c   c title = program title
c   c qfile = input daily flow file
c   c cfile = input sample concentration file
c   c nmaxc = maximum duration of composite samples
c   c dbase = first day for load calculation, yyyyymmdd
c
c   read(7,*) ofile1,dum8,ofile2,dum8,ofile3,dum8,ofile4,dum8

```

```

      read(7,*)

c output files (* = optional)
c   ofile1 - sample inventory
c   *ofile2 - daily results
c   *ofile3 - monthly results for each term
c   *ofile4 - monthly cross-tabulation (terms columns x month rows)

c open output file for sample statistics
  open(11,file=ofile1,status='unknown')
  write(11,*)
  write(11,'(a64)') title

c open daily output file
  if(ofile2.ne.blank) then
    open(12,file=ofile2,status='unknown')
    write(12,'(a64)') title
    write(12,801)
  endif

c open monthly output file
  if(ofile3.ne.blank) then
    open(13,file=ofile3,status='unknown')
    write(13,*)
    write(13,'*) flow in million cubic meter (kacre-feet)')
    write(13,*)
    write(13,'*) station month days      flow      load(kg)'
    &           , ' fwmc(ppb)  flow_neg  load_neg'
  endif

c ****
c program start for each term
c ****

c nsta = number of stations (terms)
  nsta=0

c for each station (term) in job file
100  read(7,*,end=901) term,clab,glab,qlab,dbkey,qsign,itype,iymdtp
  if(len_trim(term).le.0) goto 901
  write(11,*)
  write(11,'*) 'For ',term,':'
  write(11,'*) 'term    clab    glab    qlab',
$          'dbkey,qsign,itype,iymdtp'
  write(11,'*) term,clab,glab,qlab,dbkey,qsign,itype,iymdtp

  nsta=nsta+1
  loadcalc=.true.

c jdatei() converts yyyyymmdd to a serial date (days from Jan 1, 1900)
c   if(iymdtp.lt.dbase) then
c     iymdl=dbase
c   else
c     iymdl=iymdtp
c   endif

  jymdl=jdate(iymdl)

c term = output label for each term
c clab = composite sample station code
c glab = grab station code
c qlab = flow station code

c qsign = flow sign indicator
c   1 = use positive flows for load
c   -1 = use negative flows for load

c itype = sample type indicator
c   0 = use grab samples
c   1 = use composite samples
c   2 = use both type samples w/ priority given to composite

c capitalize labels
      CALL CONCAP(TERM,8)
      CALL CONCAP(QLAB,8)
      CALL CONCAP(CLAB,8)
      CALL CONCAP(GLAB,8)
      stations(nsta)=term
      dbkeys(nsta)=dbkey

```

```

c ****
c read daily flows for current station
c ****

do 212 i=1,6000
  dayflow(i)=xmis
212 continue

c   call tabflow(qfile,dbkeys,qfile_tab,stations,title,xmis,nsta)
call flowread(qfile,iymd1,iymd2,dbkey,nq,loadcalc)
print*,qfile,dbkey,iymd1,iymd2
jymd1=jdate(iymd1)
jymd2=jdate(iymd2)

c if file start date is not <= jymd1, jymd1
c is adjusted to the start of flow data
c jymd2 is the end of the flow data
c flow data set should contain no missing values

if(nq.le.0) go to 900

write(11,*) 'Flow data from ',kdate(jymd1), ' to ',
$           kdate(jymd2)

c ****
c load sample tp data
c ****

ngrab=0
ncomp=0
comptotal=0.0
grabtotal=0.0

do 213 i=1,6000
  dayccomp(i)=xmis
  daycgrab(i)=xmis
  cgrabint(i)=xmis
  dayload(i)=xmis
213 continue

call concread(cfile,jymd1,jymd2,clab,glab,ngrab
  ,xmis,ncomp,comptotal,grabtotal,loadcalc)

c ****
c start load calculation
c ****

c assign daily flows in cfs

do i=1,3
  flowtype(i)=0
enddo

ftotal1=0.0
ftotal2=0.0
missflow=0

do 301 j=1,nq

  if(dayflow(j).eq.xmis) then
    missflow=missflow+1
  elseif(dayflow(j).gt.0.0) then
    flowtype(2)=flowtype(2)+1
    ftotal1=ftotal1+dayflow(j)
  elseif(dayflow(j).eq.0.0) then
    flowtype(1)=flowtype(1)+1
  elseif(dayflow(j).lt.0.0) then
    flowtype(3)=flowtype(3)+1
    ftotal2=ftotal2+dayflow(j)
  endif

  dayload(j)=xmis

301 continue

if(loadcalc.ne..true.) goto 900

c calculate daily loads from grab samples by interpolation
121  if((itype.eq.0).or.(itype.eq.2)) then

```

```

)
mgrab=0
grabmin=999.0
grabmax=-999.0

c eliminate grab-samples collected on days with no flow
do 302 i=1,ngrab

  if(cgrab(i).gt.grabmax)grabmax=cgrab(i)
  if(cgrab(i).lt.grabmin)grabmin=cgrab(i)

  if(dayflow(idgrab(i)-jyndl+1).gt.0.) then
    mgrab=mgrab+1
    idgrab(mgrab)=idgrab(i)
    cgrab(mgrab)=cgrab(i)
  endif

302      continue

ngrabt=ngrab
ngrabt=mgrab

do i=1,ngrab
  x(i)=idgrab(i)-jyndl+1
enddo

if(ngrabgt.1) call eint3(ngrab,x,cgrab,nq+15,cgrabint)

  do i=1,nq
    if(dayflow(i).ne.xmis)
      dayload(i)=cgrabint(i)*dayflow(i)
  enddo

endif

c calculate loads from composite samples

dlast=0.
tmpload=0.0
tmpflow=0.0
compmin=999.0
compmax=-999.0

do 3020 i=1,ncomp
  if(ccomp(i).gt.compmax)compmax=ccomp(i)
  if(ccomp(i).lt.compmin)compmin=ccomp(i)
3020      continue

  if ((itype.eq.1).or.(itype.eq.2)) then
    do 303 i=1,ncomp

c date range to apply composite-sample concentration
    j2=idcomp(i)-jyndl+1
    j1=max0(1,j2-nmaxc)
    if(j1.le.dlast) j1=dlast+1
    if(j1.gt.j2) j1=j2

    do 304 j=j1,j2

      dayccomp(j)=ccomp(i)
      if(dayflow(i).ne.xmis)
        dayload(j)=dayflow(j)*dayccomp(j)

        if((qsign.eq.1).and.(dayflow(j).gt.0.0)) then
          tmpload=tmpload+dayflow(j)*dayccomp(j)
          tmpflow=tmpflow+dayflow(j)
        endif

304      continue

c fill in missing data periods by interpolation of adjacent data
      if(j1.gt.dlast+1) then

c use the first ccomp from the first day if iyndl is < iyndtp
c use the the last ccomp before the missing and ccomp after the missing
        if(i.eq.1) then
          xl=dlast+1

```

```

        )
        y1=ccomp(1)
    else
        xi=dlast
        yi=ccomp(i-1)
    endif

    if((j1-dlast).gt.16) then
        write(11,*)"composite sample missing more than 2 weeks"
        write(11,*)"after',kdate(dlast+jymd1-1)"
        go to 900
    endif

    do 305 j=dlast+1,j1-1
        fint=(j-x1)/(j1-x1)
        dayccomp(j)=(1.0-fint)*y1 +fint*ccomp(i)
    if(dayflow(i).ne.xmis)
        dayload(j)=dayflow(j)*dayccomp(j)
305   continue

    endif

    dlast=j2

303   continue

c fill in the end of period with the last ccomp if it end before iymd2
    if(dlast.lt.ng) then
        do 315 j=dlast+1,nq
            dayccomp(j)=ccomp(ncomp)
        if(dayflow(i).ne.xmis)
315   dayload(j)=dayflow(j)*dayccomp(j)
        continue
    endif

    endif

c calculate load ratio for days with both composite and grab samples
c for days with flow and grab sample
    ratio=0.0

    if(itype.eq.2) then

        wgtmp=0.0
        wctmp=0.0
        wftmp=0.0
        ncg=0

        do 306 i=1,nq

            if(daycgrab(i).gt.0.0.and.dayflow(i).gt.0.0) then
                wgtmp=wgtmp+daycgrab(i)*dayflow(i)
                if(itype.eq.2) wctmp=wctmp+dayccomp(i)*dayflow(i)
                wftmp=wftmp+dayflow(i)
            endif

306   continue

            if(itype.eq.2) ratio = ratv(wctmp,wgtmp)

        endif

c write log file

        if(ngrab.gt.0) then
            write(11,*) 'grab sample n = ',ngrabt
            write(11,*) ' first datum : ',kdate(idgrab(1))
            write(11,*) ' last datum : ',kdate(idgrab(ngrab))
            avggrab=ratv(grabtotal,float(ngrabt))
            write(11,*) ' average value = ',avggrab
            write(11,*) ' range = ',grabmin,' to ', grabmax
            write(11,*) 'grab sample used (n w/ +flow) = ',ngrab
            fwmgrab=ratv(wgtmp,wftmp)
            write(11,*) 'flow weighted mean (w/ +flow) = ',fwmgrab
            if(itype.eq.2) write(11,*) 'load ratio to comp = ',ratio
        endif

        if(ncomp.gt.0) then
            write(11,*) 'composite sample n =',ncomp
            write(11,*) ' first datum : ',kdate(idcomp(1))
            write(11,*) ' last datum : ',kdate(idcomp(ncomp))

```

```

        )
        write(11,*)
        write(11,*)
        write(11,*)
        write(11,*)
        write(11,*)

c flow summary
        write(11,815) flowtype(1)
        write(11,816) flowtype(2),ftotal1
        write(11,817) flowtype(3),ftotal2

c ****
c loop around month
c ****

call iyyymmdd(dbase,iy,im,id)
idbasemon=ifix(dbase/100)
m=1
kd= ifix(kdate(jymd1)/100)

122 if(idbasemon.lt.kd) then

        iym(m)=idbasemon
        im=im+1

        if(im.gt.12)then
            im=im-12
            iy=iy+1
        endif

        idbasemon=iy*100+im
        m=m+1
        go to 122

    endif

flowmon=0.0
loadmon=0.0
flowmonn=0.0
loadmonn=0.0
mm=0

do 308 i=1,nq

    jd=ifix(kdate(i+jymd1-1)/100)

c output monthly totals for current station
    if(jd.ne.kd) then

        if(flowmon.ne.xmis) then
            cc=ratv(loadmon,flowmon)
        else
            cc=xmis
        endif

        if(ofile3.ne.blank) then
            write(13,807) term,kd,mm,flowmon*sfkg,flowmon*sfkacft
            ,loadmon*sfkg,cc,flowmonn*sfkg
            ,flowmonn*sfkacft,loadmonn*sfkg
        endif

        monflow(m,nsta)=flowmon
        monload(m,nsta)=loadmon
        monflown(m,nsta)=flowmonn
        monloadn(m,nsta)=loadmonn
        iym(m)=kd
        flowmon=0.0
        loadmon=0.0
        flowmonn=0.0
        loadmonn=0.0
        mm=0
        kd=jd
        m=m+1

    endif

    num=num+1

    if(dayflow(i).gt.0.0) then
        flowmon=flowmon+dayflow(i)

```

```

        )
loadmon=loadmon+dayload(i)
else
  flowmonn=flowmonn+dayflow(i)
  loadmonn=loadmonn+dayload(i)
endif

308 continue

iym(m)=kd
monflow(m,nsta)=flowmon
monload(m,nsta)=loadmon
monflown(m,nsta)=flowmonn
monloadn(m,nsta)=loadmonn

if(ofile3.ne.blank) then

  if(flowmon.ne.xmis) then
    cc=ratv(loadmon,flowmon)
  else
    cc=xmis
  endif

  write(13,807) term,kd,mm,flowmon*sfg,flowmon*sfkacft
  & ,loadmon*sfg,cc,flowmonn*sfg
  & ,flowmonn*sfkacft,loadmonn*sfg

endif

c end of month loop

c loop around terms
900  write(11,*) missflow,' missing flow data'
go to 100

c ****
c end of station list
c ****

901 continue

c output monthly cross-tab
  if(ofile4.ne.blank)
    & call tabreport(ofile4,title,stations,iym,nsta,m)

*****
c output totals to log file
*****


      write (11,*)
      write(11,809) title

      do 311 i=1,nsta

      xtmp=0.
      ytmp=0.
      xtmpn=0.
      ytmpn=0.

      do 312 j=1,m
        if(monflow(j,i).gt.0.0) xtmp=xtmp+monflow(j,i)
        if(monload(j,i).gt.0.0) ytmp=ytmp+monload(j,i)
        if(monflown(j,i).ne.xmis) xtmpn=xtmpn+monflown(j,i)
        if(monloadn(j,i).ne.xmis) ytmpn=ytmpn+monloadn(j,i)
      continue

      yfwmc=ratv(ytmp,xtmp)

      write(11,808) stations(i),itype,xtmp*sfkacft,xtmpn*sfkacft
      & ,ytmp*sfg,ytmpn*sfg,yfwmc
      continue

999  close(7)
      close(11)
}
      if(ofile2.ne.blank) close(12)
      if(ofile3.ne.blank) close(13)

801  format('station  idate   flow(cfs)',*
      & 'ccomp(ppb) cgrab(PPb) grab-int  load(kg) ')
804  format(1h',a8,1h',i5,2i9,2i5,2i9,2f8.4,f9.1)
815  format('Number of no flow days = ', i8)

```

```

816  format('Number of positive flow days = ', i8
817  & , ' total flow (cfs-d) = ', f10.3)
818  format('Number of negative flow days = ', i8
819  & , ' total flow(cfs-d) = ', f10.3)
820  format(a8,i6,i4,f8.1,' (',f7.1,')',3f8.1,' (',f7.1,')',f8.1)
821  format(1h',a8,1h',i4,10f12.3)
822  format(a64/'Totals & Averages for the Calculation Time Period'/
823  & ' Term      Sign          Flow(kacf)           Load(kg)
824  & Conc(ppb) ')
825
826  format(i6,2f12.1,5f10.1,f8.1)

stop
end

C ****
C subroutine concread(cfile,jymd1,jymd2,clab,glab,ngrab
& ,xmis,ncomp,comptotal,grabtotal,loadcalc)
C ****

character*12 cfile
character*8 dum8,clab,glab
logical loadcalc
common /a/    dayflow(6000),dayccomp(6000),daycgrab(6000)
&           ,cgrabint(6000),dayload(6000)
common /b/    cgrab(1000),ccomp(1000),x(1000),y(1000)
common /c/    idgrab(1000),idcomp(1000)

c scale factor to convert input sample concs (ppm) to (ppb)
data sfppb/1000.0/

open(9,file=cfile,status='old')

c read next sample
101  read(9,802,end=110) dum8,idd,isample,conc
802  format(a8,10x,i8,12x,i2,f9.3)
     if(dum8.eq.blank)goto 101

)   c isample
)   c 0 grab sample
)   c 24 autosampler composite sample

c convert yyyymmdd to days from Jan 1, 1900
jdd=jdate(idd)
jd0=jdate(jymd1)
if(jdd.lt.jd0)goto 101

c check stations
CALL CONCAP(DUM8,8)
if((dum8.ne.clab).and.(dum8.ne.glab)) go to 101

c check date
if(jdd.lt.jymd1.or.jdd.gt.jymd2+15) go to 101

c check for valid sample value
if(conc.eq.0.) go to 101

c rescale concentration and set to absolute value
c (negative values is < detection limit)
conc=sfppb*abs(conc)
ithday=jdd-jymd1+1

c process composite sample
if(isample.eq.24) then

    if(dayccomp(ithday).ne.xmis) then
        write(11,*) 'duplicate data in composite sample',dum8,idd
        loadcalc=.false.
        return
    endif

    dayccomp(ithday)=conc
    ncomp=ncomp+1
    ccomp(ncomp)=conc
    idcomp(ncomp)=jdd
    comptotal=comptotal+conc

)   else

c process grab sample

```

```

        if(daycgrab(ithday).ne.xmis) then
          write(11,*) 'duplicate data in grab sample',dum8,idd
          loadcalc=.false.
          return
        endif

        daycgrab(ithday)=conc
        ngrab=ngrab+1
        cgrab(ngrab)=conc
        idgrab(ngrab)=jdd
        grabtotal=grabtotal+conc

      endif

      go to 101

110  continue
      close(9)

      return
    end

C ****
C subroutine flowread(qfile,ibdate,iedate,dbkey,nq,loadcalc)
C ****

c reads daily flows
c missing values not allowed in flow file

character*12 qfile
character*5 dbkey,qlab
character*80 record
character*9 cvalue
logical loadcalc
real x(6000),y(6000)

common /a/   dayflow(6000),dayccomp(6000),daycgrab(6000)
&           ,cgrabint(6000),dayload(6000)

) c the labels correspond to flow dbkeys in control file

c open input flow file
  open (8, file=qfile,status='old')
c  rewind (8)
  nq = 0
  jbdate=jdate(ibdate)

20  read(8,'(a80)',end=100) record
  if(len_trim(record).le.0) goto 100
  read(record,801) idd,qlab,cvalue
801  format(i8,3x,a5,a9)

  if(len_trim(cvalue).le.0)then
    write(11,*)"missing flow data",idd,qlab
    loadcalc=.false.
    return
  else
    read(record,810) idd,qlab,value
810  format(i8,3x,a5,f9.1)
    endif

c convert yymmdd to julian
  if(dbkey.ne qlab)goto 20
  jfdate=jdate(idd)
  if(jfdate.lt.jbdate) goto 20
  if(nq.eq.0.and.jfdate.gt.jbdate) then
    ibdate=idd
    jbdate=jfdate
  elseif(nq.gt.0.and.jfdate-jflast.gt.1) then
    write(11,*)"flow file dates out of sequence: ",idd
    loadcalc=.false.
    return
  endif
  nq=nq+1
  jflast=jfdate
29  dayflow(nq) = value
  go to 20
100 iedate=idd
101 close (8)
  do 1000 i=1,nq

```

```

        x(i)=i
        y(i)=dayflow(i)
1000  continue
        if(nq.le.1) return
        xmax=float(nq)
        return
        end

c ****
c functions and subroutines
c ****

        function idate(iy,im,id)
        integer mdy(12)
        DATA MDY/0,31,59,90,120,151,181,212,243,273,304,334/
c returns days from Jan 1, 1900 for input iy,im,id
c year in yyyy format
        idate=0
c check for valid date
        if(im.le.0.or.im.gt.12) return
        if(id.lt.1.or.id.gt.mday(iy,im)) return
        idate=mdy(im)+(iy-1900)*365+id+ifix((iy-1897)/4)
c add 1 day if leap year and after february
        if((mod(iy,4).eq.0).and.(im.gt.2)) idate=idate+1
        return
        end

        function jdate(iymd)
c returns date sequence number for input in yyyyymmdd format
        iy=iymd/10000
        im=(iymd-iy*10000)/100
        id=iymd-iy*10000-im*100
        jdate=idate(iy,im,id)
        return
        end

        function kdate(id)
c returns integer date yyyyymmdd for serial date id
c   number of days from Jan 1, 1900
        kdate=0
        if(id.le.0) return
c first find year, roughly
        jy=id/367
13      if(idate(jy+1,1,1).le.id) then
            jy=jy+1
            goto 13
        endif
c find month
        do 10 jm=2,12
            if(idate(jy,jm,1).gt.id) goto 12
10      continue
12      jm=jm-1
c find day
        jd=id-idate(jy,jm,1)+1
c compute ddate
        kdate=10000*jy+jm*100+jd
        return
        end

        subroutine iyyymmdd(idate,iy,im,id)
c convert integer date to integer year, month, day
        iy=ifix(idate/10000)
        im=ifix((idate-iy*10000)/100)
        id=ifix(idate-iy*10000-im*100)
        return
        end

        function mday(iy,im)
c number of days in current month
        dimension mdy(12)
        data mdy/31,28,31,30,31,30,31,31,30,31,30,31/
        mday=0
        if(im.gt.12.or.im.lt.1) return
        mday=mdy(im)
        if((im.eq.2).and.mod(iy,4).eq.0.) mday=mday+1
        return
        end

```

```

        subroutine eint3(n,xi,ci,nq,wi)
c interpolation
c inputs xi(i),ci(i),i=1,n
c output wi(j),j=1,nq
      dimension ci(1),xi(1),wi(1)
      i=1
      do 100 j=1,nq
         if(j.gt.xi(i)) go to 110
         wi(j)=ci(i)
         go to 100
110      if(j.lt.xi(n)) go to 120
         wi(j)=ci(n)
         go to 100
120      if(j.le.xi(i+1)) go to 125
         i=i+1
         go to 120
125      f=(j-xi(i))/(xi(i+1)-xi(i))
         wi(j)=(1.-f)*ci(i)+f*ci(i+1)
100      continue
      return
      end

      function ratv(x1,x2)
c divide x1 by x2 or set to 0.
      if(x2.ne.0.0) then
         ratv=x1/x2
      else
         ratv=0.0
      endif
      return
      end

      subroutine concap(string,n)
c convert string to caps
      character*12 string
      do i=1,n
         j=ichar(string(i:i))
         if(j.gt.96.and.j.lt.123) string(i:i)=char(j-32)
      enddo
      return
      end

      function idbt(id1,id2)
c days between id1 & id2, inclusive
      idbt=jdate(id2)-jdate(id1)+1
      return
      end

      function len_trim(line)
c count number of non-blank ascii character in a string
      character*80 string
      character*80 line
      string=' '
      string=line
      n=len(string)
      len_trim=0
      do 10 i=1,n
         icharnum=ichar(string(i:i))
         if((icharnum.gt.32).and.(icharnum.lt.123))
10            len_trim=len_trim + 1
      continue
      return
      end

```

Appendix III.

Total phosphorus data for the period: June 1, 1996 - February 28, 1997.

For Northfeeder: Flow proportional autosampler TP.

Station	Project	Date	TP (ppm)
NFEED	CAMB	19960626	0.351
NFEED	CAMB	19960703	0.334
NFEED	CAMB	19960710	0.265
NFEED	CAMB	19960718	0.204
NFEED	CAMB	19960725	1.296*
NFEED	CAMB	19960801	0.163
NFEED	CAMB	19960808	0.163
NFEED	CAMB	19960814	0.124
NFEED	CAMB	19960822	0.138
NFEED	CAMB	19960828	0.087
NFEED	CAMB	19960904	0.117
NFEED	CAMB	19960912	0.115
NFEED	CAMB	19960919	0.095
NFEED	C139	19960925	0.103
NFEED	C139	19961003	0.095
NFEED	C139	19961010	0.090
NFEED	C139	19961017	0.200
NFEED	C139	19961024	0.219
NFEED	C139	19961031	0.071
NFEED	C139	19961107	0.125
NFEED	C139	19961114	0.138
NFEED	C139	19961121	0.100
NFEED	C139	19961127	0.110
NFEED	C139	19961205	0.059
NFEED	C139	19961211	0.061
NFEED	C139	19961219	0.089
NFEED	C139	19961226	0.067
NFEED	C139	19970102	0.043
NFEED	C139	19970109	0.047
NFEED	C139	19970123	0.044
NFEED	C139	19970130	-0.004
NFEED	C139	19970206	0.036
NFEED	C139	19970213	0.042
NFEED	C139	19970220	0.055

* denotes a sample deemed to be contaminated with suspended solids.
- denotes a less than the detection limit value.

For Westfeeder: Flow proportional autosampler TP.

Station	Project	Date	TP (ppm)
WFEED	CAMB	19960613	0.106
WFEED	CAMB	19960620	0.068
WFEED	CAMB	19960626	0.072
WFEED	CAMB	19960703	0.042
WFEED	CAMB	19960710	0.045
WFEED	CAMB	19960718	0.058
WFEED	CAMB	19960904	0.036
WFEED	C139	19961010	0.110
WFEED	C139	19961017	0.061
WFEED	C139	19961024	0.049
WFEED	C139	19961031	0.119
WFEED	C139	19961107	0.041
WFEED	C139	19961114	0.039
WFEED	C139	19961121	0.018
WFEED	C139	19961127	0.019
WFEED	C139	19961205	0.011
WFEED	C139	19961211	0.009
WFEED	C139	19970123	0.014
WFEED	C139	19970220	0.014

For L3BRS: Flow proportional autosampler TP.

Station	Project	Date	TP (ppm)
USL3BRS	CAMB	19960606	0.240
USL3BRS	CAMB	19960613	0.278
USL3BRS	CAMB	19960620	0.273
USL3BRS	CAMB	19960626	0.487
USL3BRS	CAMB	19960703	0.359
USL3BRS	CAMB	19960710	0.271
USL3BRS	CAMB	19960718	0.178
USL3BRS	CAMB	19960725	0.132
USL3BRS	CAMB	19960801	0.113
USL3BRS	CAMB	19960808	0.148
USL3BRS	CAMB	19960814	0.128
USL3BRS	CAMB	19960822	0.311
USL3BRS	CAMB	19960828	0.246
USL3BRS	CAMB	19960904	0.185
USL3BRS	CAMB	19960912	0.107
USL3BRS	CAMB	19960919	0.074
USL3BRS	C139	19960925	0.089
USL3BRS	C139	19961003	0.075
USL3BRS	C139	19961010	0.287
USL3BRS	C139	19961017	0.220
USL3BRS	C139	19961024	0.268
USL3BRS	C139	19961107	0.141
USL3BRS	C139	19961114	0.156
USL3BRS	C139	19961121	0.073
USL3BRS	C139	19961127	0.058
USL3BRS	C139	19961205	0.029
USL3BRS	C139	19961211	0.044
USL3BRS	C139	19970109	0.019
USL3BRS	C139	19970130	0.027
USL3BRS	C139	19970227	0.049
USL3BRS	C139	19970306	0.023
USL3BRS	C139	19970327	0.015

For L3BRS: Grab sample TP.

Station	Project	Date	TP (ppm)
L3BRS	CAMB	19960613	0.265
L3BRS	CAMB	19960627	0.425
L3BRS	CAMB	19960711	0.205
L3BRS	CAMB	19960725	0.107
L3BRS	CAMB	19960808	0.145
L3BRS	CAMB	19960822	0.133
L3BRS	CAMB	19960904	0.144
L3BRS	CAMB	19960919	0.097
L3BRS	C139	19961003	0.075
L3BRS	C139	19961017	0.196
L3BRS	C139	19961031	0.163
L3BRS	C139	19961114	0.084
L3BRS	C139	19961127	0.050
L3BRS	C139	19961211	0.064
L3BRS	C139	19970123	0.041
L3BRS	C139	19970220	0.048
L3BRS	C139	19970320	0.024

For USSO: Flow proportional autosampler TP.

Station	Project	Date	TP (ppm)
USSO	CAMB	19960606	0.063
USSO	CAMB	19960613	0.066
USSO	CAMB	19960620	0.042
USSO	CAMB	19960626	0.068
USSO	CAMB	19960703	0.055
USSO	CAMB	19960710	0.077
USSO	CAMB	19960718	0.084
USSO	CAMB	19960725	0.110
USSO	CAMB	19960801	0.220
USSO	CAMB	19960808	0.163
USSO	CAMB	19960814	0.211
USSO	CAMB	19960822	0.657
USSO	CAMB	19960828	0.174
USSO	CAMB	19960904	0.152
USSO	CAMB	19960912	1.212
USSO	CAMB	19960919	0.304
USSO	C139	19960925	1.064*
USSO	C139	19961003	0.880*
USSO	C139	19961010	0.444
USSO	C139	19961017	0.320
USSO	C139	19961024	0.228
USSO	C139	19961031	0.734
USSO	C139	19961107	3.424*
USSO	C139	19961114	1.194*
USSO	C139	19961121	0.709*
USSO	C139	19961127	0.600*
USSO	C139	19961205	0.514*
USSO	C139	19961211	0.035*
USSO	C139	19961219	0.066*
USSO	C139	19970102	0.046*
USSO	C139	19970109	0.057*
USSO	C139	19970116	0.973*
USSO	C139	19970123	0.049
USSO	C139	19970130	0.034
USSO	C139	19970206	0.069
USSO	C139	19970213	0.066
USSO	C139	19970220	0.064
USSO	C139	19970227	0.055
USSO	C139	19970306	1.118*
USSO	C139	19970312	0.196
USSO	C139	19970319	0.226
USSO	C139	19970327	0.136

* denotes a sample deemed to be contaminated with suspended solids.

) For USSO: Grab sample TP.

Station	Project	Date	TP (ppm)
USSO	CAMB	19960627	0.064
USSO	CAMB	19960613	0.068
USSO	CAMB	19960711	0.106
USSO	CAMB	19960725	0.170
USSO	CAMB	19960808	0.128
USSO	CAMB	19960822	0.122
USSO	CAMB	19960904	0.134
USSO	CAMB	19960919	0.095
USSO	C139	19961003	0.057
USSO	C139	19961017	0.071
USSO	C139	19961031	0.076
USSO	C139	19961114	0.030
USSO	C139	19961127	0.032
USSO	C139	19961211	0.052
USSO	C139	19970123	0.061
USSO	C139	19970220	0.069
USSO	C139	19970320	0.214

) For S190: Grab sample TP.

Station	Project	Date	TP (ppm)
S190	CAMB	19960613	0.102
S190	CAMB	19960627	0.244
S190	CAMB	19960711	0.127
S190	CAMB	19960725	0.116
S190	CAMB	19960808	0.055
S190	CAMB	19960822	0.055
S190	CAMB	19960904	0.133
S190	CAMB	19960919	0.049
S190	C139	19961003	0.074
S190	C139	19961017	0.151
S190	C139	19961031	0.108
S190	C139	19961114	0.056
S190	C139	19961127	0.046
S190	C139	19961211	0.040
S190	C139	19970123	0.022
S190	C139	19970220	0.020
S190	C139	19970320	0.017

) For S140: Grab sample TP.

Station	Project	Date	TP (ppm)
S140	CAMB	19960613	0.039
S140	CAMB	19960627	0.036
S140	CAMB	19960711	0.043
S140	CAMB	19960725	0.047
S140	CAMB	19960808	0.055
S140	CAMB	19960822	0.113
S140	CAMB	19960904	0.067
S140	CAMB	19960919	0.034
S140	C139	19961003	0.048
S140	C139	19961017	0.028
S140	C139	19961031	0.027
S140	C139	19961114	0.024
S140	C139	19961127	0.022
S140	C139	19961211	0.069
S140	C139	19970123	0.038
S140	C139	19970220	0.030
S140	C139	19970320	0.026